Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims

51. (Previously Presented) A method of reducing acoustic feedback in a system comprising:

sequentially converting a buffered acoustic signal to a plurality of frames in a frequency domain, each frame comprising an array of frequency magnitude bins;

comparing a first value of a first frequency magnitude bin that is included in a first frame with a second value of the first frequency magnitude bin that is included in a second frame;

in response to the second value being greater than the first value, increasing the first value as a function of the first value, the second value and a determined filter coefficient;

selecting the first frequency magnitude bin to be a candidate frequency; and

setting a notch filter to the candidate frequency at an attenuation depth and a bandwidth to suppress feedback.

52. (Previously Presented) The method of Claim 51 further comprising setting the first value equal to the second value in response to the second value being less than the first value.

53. (Previously Presented) The method of Claim 51 where increasing the first value comprises calculating the filter coefficient as a function of a threshold, a time constant, and a frame sample rate.

54. (Currently Amended) The method of Claim 51 where selecting the first frequency magnitude bin comprises <u>determining that the first value is at least a predetermined magnitude.</u> ~~monitoring the first frequency magnitude bin for the first value to iteratively increase to be greater than a threshold value.~~

55. (Previously Presented) The method of Claim 54 where the filter coefficient comprises an adjustable time constant, and monitoring the first frequency magnitude bin comprises monitoring over a determined number of the frames based on the adjustable time constant.

56. (Previously Presented) The method of Claim 55 where monitor the first frequency magnitude bin further comprises adjusting the adjustable time constant based on a frequency of sound being represented in the first frequency magnitude bin.

57. (Previously Presented) The method of Claim 55 where monitor the first frequency magnitude bin further comprises applying a longer time constant to the first frequency magnitude bin in response to the first frequency magnitude bin being representative of a lower sound frequency, and applying a shorter time constant to the first frequency magnitude bin in response to the first frequency magnitude bin being representative of a higher sound frequency.

58. (Previously Presented) The method of Claim 55 where the adjustable time constant is of the range 200 milliseconds to 2 seconds.

59. (Previously Presented) The method of Claim 55 where the adjustable time constant is defined as the time taken to reach 6dB below a threshold.

60. (Previously Presented) The method of Claim 54 where monitoring the first frequency magnitude bin further comprises comparing an amplitude of the first value to a relative threshold of the buffered acoustic signal and an absolute threshold.

61. (Previously Presented) The method of Claim 60 where comparing an amplitude of the first value comprises calculating the relative threshold as a function of an energy level of the buffered acoustic signal and a predetermined relative multiplier.

62. (Previously Presented) The method of Claim 60 where the absolute threshold is a determined decibel level.

63. (Previously Presented) A method of reducing acoustic feedback in a system comprising:

sequentially converting a buffered acoustic signal to a plurality of sequential frames in a frequency domain, each frame comprising an array of frequency magnitude bins;

comparing an old value of a first frequency magnitude bin that is included in a first frame of the sequential frames with a new value of the first frequency magnitude bin that is included in a second frame of the sequential frames;

in response to the new value being greater than the old value, adjusting the old value based on the new value and a filter coefficient;

identifying the first frequency magnitude bin as a candidate frequency in response to the adjusted old value exceeding a threshold value; and

testing for a predetermined amount of reduction in a measured amplitude at the candidate frequency by application of a notch filter to the candidate frequency.

64. (Previously Presented) The method of Claim 63 where adjusting the old value comprises calculating the filter coefficient based on a determined time value to reach the threshold value.

65. (Previously Presented) The method of Claim 64 where calculating the filter coefficient comprises defining the determined time value as the time taken to reach 6dB below the threshold value.

66. (Previously Presented) The method of Claim 63 where identifying the first frequency magnitude bin as a candidate frequency comprises passing an amplitude and a frequency magnitude bin number of the old value to a threshold detection process.

67. (Previously Presented) The method of Claim 63 where identifying the first frequency magnitude bin as a candidate frequency comprises determining when the old value is above a relative threshold and an absolute threshold.

68. (Previously Presented) The method of Claim 63 where identifying the first frequency magnitude bin as a candidate frequency comprises detecting a threshold and comparing the magnitude of the frequency magnitude bin to an absolute threshold variable and, in response to the magnitude being less than the absolute threshold variable, discontinuing identification of the frequency bin as the candidate frequency.

69. (Previously Presented) The method of Claim 63 where testing for a predetermined amount of reduction further comprises assigning a state machine to the candidate frequency and executing a state machine algorithm.

70. (Previously Presented) The method of Claim 69 where assigning a state machine comprises assigning a plurality of state machines that are equal to a plurality of notch filters being simultaneously applied to a plurality of candidate frequencies.

71. (Previously Presented) The method of Claim 63 where testing for a predetermined amount of reduction comprises setting the notch filter to the candidate frequency at a given attenuation depth and bandwidth.

72. (Previously Presented) The method of Claim 63 further comprising tracking the status of the notch filter with a state machine.

73. (Previously Presented) The method of Claim 63 further comprising bypassing the notch filter if the amount of reduction in a measured amplitude at the candidate frequency is not reduced by the predetermined amount.

74. (Previously Presented) The method of Claim 63 where the predetermined amount is 3dB.

75. (Previously Presented) The method of Claim 63 further comprising assigning a state machine; tracking the status of the notch filter with the state machine, bypassing the notch filter if the amount of reduction in a measured amplitude at the candidate frequency is not reduced by the predetermined amount, and reassigning the state machine and the notch filter to another candidate frequency.

76. (Previously Presented) The method of Claim 63 where testing for a predetermined amount of reduction further comprises setting the notch filter to an attenuation depth of 6dB.

77. (Previously Presented) The method of Claim 76 where setting the notch filter further comprises increasing the attenuation depth of the notch filter when feedback is detected at the candidate frequency already being filtered.

78. (Currently Amended) A method of reducing acoustic feedback in a system comprising:

sampling a sound signal at predetermined intervals to iteratively create a set of sampled sound signals;

transforming each one of the set of sampled sound signals to a frequency spectrum comprising a plurality of frequency magnitude bins, each of the frequency magnitude bins comprising a bin value indicative of a magnitude of a frequency of the sound signal over a predetermined frequency range;

comparing an [[first]] old bin value in a first sampled sound signal included in the set of sampled sound signals with a [[first]] new bin value in a second sampled sound signal included in the set of sampled sound signals; and

setting the [[first]] old bin value in the first sampled sound signal equal to the [[first]] new bin value in the second sampled sound signal in response to the [[first]] new bin value in the second sampled sound signal being less than the [[first]] old bin value in the first sampled sound signal;

increasing the [[first]] old bin value in the first sampled sound signal as a function of the [[first]] old bin value in the first sampled sound signal, the [[first]] new bin value in the second sampled sound signal and a determined filter coefficient in response to the [[first]] new bin value in the second sampled sound signal being greater than the [[first]] old bin value in the first sampled sound signal;

selecting a first frequency magnitude bin to be a candidate frequency; and

setting a notch filter to the candidate frequency at an attenuation depth and a bandwidth to suppress feedback.

79. (Previously Presented) A method of reducing acoustic feedback in a system comprising:

selecting a candidate frequency of an acoustic signal;

assigning a state machine to the candidate frequency;

testing the candidate frequency by setting a notch filter associated with the state machine to the candidate frequency at a determined depth and bandwidth;

tracking a status of the notch filter and determining whether the notch filter is idle or filtering;

measuring an amplitude of the candidate frequency after a predetermined test time to determine whether the amplitude has been reduced by a determined value;

setting the notch filter to a depth of 0dB in response to the amplitude of the candidate frequency not being reduced by the determined value; and

reassigning the state machine to a different candidate frequency.

80. (Previously Presented) The method of Claim 79 further comprising setting the filter in a filtering state at the candidate frequency to the determined depth and bandwidth in response to the candidate frequency being reduced by the determined value.

81. (Previously Presented) The method of Claim 79 where measuring an amplitude of the candidate frequency comprises comparing a reduction in the amplitude to the determined value of 3dB.

82. (Previously Presented) A system for reducing unwanted acoustic feedback comprising:

a processor;

a memory accessible to the processor;

programming comprising instructions stored in the memory to sequentially convert a buffered acoustic signal to a plurality of frames in a frequency domain, each frame comprising an array of frequency magnitude bins;

programming comprising instructions stored in the memory to compare a first value of a first frequency magnitude bin that is included in a first frame with a second value of the first frequency magnitude bin that is included in a second frame;

programming comprising instructions stored in the memory to, in response to the second value being greater than the first value, increase the first value as a function of the first value, the second value and a determined filter coefficient;

programming comprising instructions stored in the memory to select the first frequency magnitude bin to be a candidate frequency; and

programming comprising instructions stored in the memory toset a notch filter to the candidate frequency at an attenuation depth and a bandwidth to suppress feedback.

83. (Previously Presented) The system of Claim 82 where programming comprising instructions stored in the memory to compare a first value further comprises programming comprising instructions stored in the memory to set the first value equal to the second value in response to the second value being less than the first value.

84. (Previously Presented) The system of Claim 82 where programming comprising instructions stored in the memory to, in response to the second value being greater than the first value, increase the first value comprises programming comprising instructions stored in the memory to calculate the filter coefficient as a function of a determined threshold, a determined time constant, and a frame sample rate.

85. (Currently Amended) The system of Claim 82 where programming comprising instructions stored in the memory to selecte the first frequency magnitude bin comprises programming comprising instructions stored in the memory to <u>determine that the first value is at least a predetermined magnitude.</u> ~~monitor the first frequency magnitude bin for the first value to iteratively increase to greater than a threshold value.~~

86. (Previously Presented) The system of Claim 84 where the filter coefficient has an adjustable time constant, and programming comprising instructions stored in the memory to monitor the first frequency magnitude bin comprises programming

comprising instructions stored in the memory to monitor over a determined number of the frames based on the adjustable time constant.

87. (Previously Presented) The system of Claim 86 where instructions stored in the memory to monitor over a determined number of the frames further comprises programming comprising instructions stored in the memory to adjust the adjustable time constant based on a frequency of sound being represented in the first frequency magnitude bin.

88. (Previously Presented) The system of Claim 86 where instructions stored in the memory to monitor over a determined number of the frames further comprises programming comprising instructions stored in the memory to apply a longer time constant to the first frequency magnitude bin in response to the first frequency magnitude bin being representative of a lower sound frequency, and programming comprising instructions stored in the memory to apply a shorter time constant to the first frequency magnitude bin in response to the first frequency magnitude bin being representative of a higher sound frequency.

89. (Previously Presented) A method of reducing acoustic feedback in a system comprising:

passing a first candidate frequency to a state machine having a time limit;

identifying a second candidate frequency;

checking a state flag to determine whether the state flag is in a testing state for the first candidate frequency passed to the state machine; the testing state further comprising:

determining whether the time limit for the state machine has expired;

retrieving a current bin magnitude of the first candidate frequency in response to expiration of the time limit;

comparing the current bin magnitude of the first candidate frequency to a determined value;

determining whether the second candidate frequency is set to a substantially similar frequency as the first candidate frequency;

increasing a depth of a notch filter in response to determination that the second candidate frequency is the substantially similar frequency as the first candidate frequency; and

setting the state flag to filtering in response to the current bin magnitude being reduced by the determined value.

90. (Previously Presented) The method of Claim 89 further comprising setting the state flag to idle in response to lack of a reduction in the current bin magnitude by the determined amount; and determining new filter parameters.

91. (Previously Presented) The method of Claim 90 where the new filter parameters include a new frequency, a bandwidth, and a notch depth.

92. (Previously Presented) The method of Claim 91 where the determining step further comprises determining a bandwidth of the filter as a function of a sampling rate.

93. (Previously Presented) A system for reducing acoustic feedback, comprising:

converting means for sequentially converting a buffered acoustic signal to a plurality of frames in a frequency domain, each frame comprising an array of frequency magnitude bins;

comparing means for comparing a first value of a first frequency magnitude bin that is included in a first frame with a second value of the first frequency magnitude bin that is included in a second frame;

in response to the second value being greater than the first value, the comparing means configured to increase the first value as a function of the first value, the second value and a determined filter coefficient;

selecting means for selecting the first frequency magnitude bin to be a candidate frequency; and

setting means for setting a notch filter to the candidate frequency at an attenuation depth and a bandwidth to suppress feedback.